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SPECIFICATION FOR PRISMATIC BINOCULARS FOR COMMON USE

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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July 1965

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Indian Standard
SPECIFICATION FOR PRISMATIC BINOCULARS FOR COMMON USE

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Indian Standard
SPECIFICATION FOR PRISMATIC BINOCULARS FOR COMMON USE

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 13 May 1965, after the draft finalized by the Optical and Mathematical Instruments Sectional Committee had been approved by the Mechanical Engineering Division Council.

0.2 A pair of prismatic binoculars, which consists of two prismatic telescopes held together with their optic axes parallel, is an instrument which affords a stereoscopic magnified view of an object and provides an erect image.

0.3 This standard deals with the requirements of hand-held prismatic binoculars for common use. Binoculars which are subjected to severe conditions of service are not covered in this standard, but they may be procured by reference to this standard and may be subjected to further testing which may be agreed to between the purchaser and the supplier.

0.4 Binoculars are specified by the magnification and aperture of the objective. For example, in a pair of 6×30 binoculars, 6× stands for angular magnification of the instrument and 30 represents the aperture of the objective expressed in millimetres.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS:2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes the requirements and methods of test for hand-held prismatic binoculars for common use.

For special requirements of any other type of binoculars intended for a particular purpose, reference should be made to the relevant specification for the specific type of binoculars.

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*Rules for rounding off numerical values (*revised*).

2. TERMINOLOGY

2.0 For the purpose of this standard, the definitions given in IS : 1399-1959* and the following shall apply.

2.1 Centre Hinge and Axle — The part about which the two telescopes of the binoculars may be swung together or apart, for the adjustment of interocular distance.

2.2 Individual Focusing Mechanism — A mechanism which allows adjustment of focus of the telescopes individually.

2.3 Centre Focusing Mechanism — A mechanism provided over the centre hinge for focusing both telescopes together.

2.4 Eye-Cups — Cup shaped components which are fitted on to the eyepieces. Their design and size are such that the binocular is held at the proper distance from the eye, to facilitate the full utilization of field of view.

2.5 Eyepiece Barrel — The tube fixed to the binocular body in which the eyepiece moves in its cell.

2.6 Dioptric Scale — A scale provided on the eyepiece or eyepieces to facilitate focusing to suit individual eye.

2.7 Interocular Distance Scale — A scale fitted over the hinge to indicate the distance at which the two oculars are set to suit the person using the binoculars.

3. GENERAL REQUIREMENTS

3.1 The binocular shall have a convenient shape and size and shall provide a good grip.

3.2 The binoculars shall be of individual focusing type.

3.2.1 The focusing movement of the eyepiece or eyepieces should be smooth and even. A minimum travel of five dioptres on either side of the index line shall be provided.

3.2.2 The eyepiece or eyepieces should be provided with a dioptric scale.

3.2.3 The dioptre indicating line shall be central on the eyepiece barrel and be towards the observer.

3.3 The design shall be such that it permits an easy collimation of the binoculars.

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*Glossary of terms used in optical technology.

3.4 Optical components, except the reflecting surfaces of the prisms, shall preferably be bloomed. The quality of the coated film shall satisfy the requirements of IS : 988-1959*.

3.4.1 The optical system shall be free from aberrations over at least two-thirds of the field of view.

3.4.2 The cemented components shall be practically free from colour, bubbles, strae or any other inclusions.

3.5 The internal surfaces of the binoculars shall be finished dull black.

3.6 In case of sealed type binoculars, the telescopes shall be hermetically sealed, unless otherwise stipulated, to afford protection against fogging, filming and fungus growth on the optical components. Provision may also be made to incorporate a tell-tale desiccant like silicagel with indicator, within the oculars.

3.6.1 In case of sealed type binoculars, the telescopes shall be fumigated and desiccated before final sealing, if required.

3.7 Materials

3.7.1 The materials used for the optics shall conform to the requirements of IS : 988-1959* and IS : 1400-1960†.

3.7.2 The materials used for the manufacture of the mechanical parts of the binoculars shall be strong but light in weight, of good quality and free from flaws and defects.

3.7.3 Lubricants, greases, lutings, cements, paints used shall be appropriate to the temperature conditions likely to be encountered in normal use. Their properties shall conform to the requirements stipulated in the relevant specifications. The range of temperature and humidity applicable to this standard are −10° to +55°C temperature and 95 percent relative humidity, unless otherwise specified to suit special requirements or abnormal conditions.

3.7.4 The screws which are fitted into the body of the binoculars shall be of such a material that there is no corrosion due to electrolytic reaction between two dissimilar metals.

3.8 Provision shall be made for fixing a neck-sling to the binocular.

3.9 A carrying case, preferably made out of good quality durable leather and suitably treated for protection against moisture and mould growth, shall be provided. The case shall be provided with a strap of suitable length for carrying the case round the shoulder.

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*General requirements for optical components.

†Specification for optical glass.

3.10 The neck-sling shall be of good quality leather treated with a suitable fungicide; or approved quality 2 ply web, the yarn being moisture-proofed, finished pure, calendered and shrunk. The neck-sling shall preferably be 90 cm long and 9 mm wide.

3.11 The outer surfaces of the binocular bodies shall be covered with a well-adherent heat-insulating material having a grained finish. The finish shall be such that it affords a good grip.

4. FUNCTIONAL REQUIREMENTS

4.1 Binoculars shall have normally a magnification of not more than 10 × and shall be light in weight.

4.1.1 The two telescopes shall have equal magnification.

4.1.2 The exit pupil should preferably be not less than 4 mm in diameter.

4.2 With dioptric scales set to zero, the eye-cups should be at equal height above the cover plates.

4.3 The movement of the telescopes about the centre hinge and axle shall be smooth and even but sufficiently stiff so that the two telescopes do not move from the adjusted position in normal use.

4.3.1 The centre hinge and axle arrangement should admit an interocular extension from 54 mm to 74 mm and an interocular scale shall be provided on the centre hinge and axle assembly to facilitate adjustment of the interocular distance.

4.3.2 If desired by the purchaser, the interocular extensions 54, 56, 58, 60, 62, 64, 66, 68, 70, 72 and 74 mm shall be marked. The 54, 64 and 74 mm graduations shall be figured. The markings shall be sharply defined.

4.4 All optical components shall be mounted rigidly and the binoculars shall not go out of collimation when it is subjected to normal jerks and jolts.

4.5 When a pair of binoculars is provided with a graticule, it shall normally be fitted in the right ocular. The graticule may provide fine markings at 1/2° intervals, when desired by the purchaser.

4.6 When filters are provided, these shall be of optical quality and of suitable transmission characteristics as specified.

4.7 The focusing movement shall provide a minimum travel of five dioptres on either side of zero index. The dioptric scale shall be graduated at intervals of one dioptre. The graduations '+5' and '−5' shall be figured.

5. TESTS

5.0 Where no method of test is indicated in this standard, the method given in IS : 2754-1964* shall be followed.

5.1 General Requirement Tests

5.1.1 The binoculars shall initially be examined for the following possible defects, the presence of any one of them shall render the instrument liable for rejection:

a) Loose, missing or damaged screws;

b) Damage to eye-cups or binocular body or general external finish;

c) Scratched, broken or dirty optical components;

d) Deterioration of the optical cement or the anti-reflection coatings; and

e) The lenses and prisms when viewed by transmitted or reflected light shall be perfectly free from any appearance of greyness or cloudiness on the surface. Any such defects causing a milky appearance or want of brilliancy of the object viewed shall render the binocular liable to rejection. The lenses and prisms shall be free from bubbles, strae, film, dust and fractures.

5.1.2 The focusing movement shall be tested as follows:

a) The focusing eyepiece or eyepieces shall be rotated through the entire range of their movement. The. movement shall be smooth, even and free from play.

b) When the binocular is centre focusing type, the centre focusing mechanism shall also be tested for its smooth and even movement.

5.1.3 *Rigidity of the Centre Hinge and Axle* — The action of the centre hinge and axle shall be smooth and even and there shall be no sign of shake. The oculars shall remain firm in any position in which these may be set within interocular extensions of 54 to 74 mm.

5.1.4 *Dioptric Scale Setting* — The dioptric scale shall read to within half a division of zero when the binoculars are carefully adjusted to normal focus against a collimator or on a distant point using auxiliary telescope. The accuracy of the zero mark shall be tested by means of an auxiliary telescope. The auxiliary telescope shall first be sharply focused on a distant object. The binocular shall then be placed in front of the telescope and the eyepiece of the binocular turned until the distant object is again sharply in position. The accuracy of the other divisions of the dioptric scale shall be tested by placing standard lenses between the auxiliary telescope and the binocular under test and re-focusing the eyepiece. The dioptric scale provided on the eyepiece or eyepieces shall not differ from actual value at any position by more than ¼ *D*.

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*General requirements for optical instruments.

5.1.5 When the dioptric scales are set to zero, the eye-cups shall be at equal heights above the cover plates to within 1·5 mm.

5.1.6 *Interocular Scale* — The interocular scale shall be in correct relationship with the exit pupils of the eyepieces to within one millimetre. The interocular scale shall be tested by measuring the distance across the eye-cups, the measurement being taken from the side of one eye-cup to the same side of the other.

5.1.7 *Pupils* — The effective aperture of the object glass shall be measured by means of a slide gauge and the diameter of the exit pupil shall be measured by means of a dynameter. The exit pupil shall not vary more than 5 percent from the value specified.

5.2 Performance Tests

5.2.1 *Magnification* — The magnification shall be determined either by dividing the effective aperture of the object glass by the diameter of the exit pupil or by placing the binocular between twin collimators and twin telescopes which have scales of equal angular subtense in their image plane and noting the magnification of the collimator scales. The magnification shall not differ from the specified value by more than 5 percent and the magnification of one ocular shall not differ by more than 2 percent from that of the other ocular in the case of a binocular having nominal magnification of 6 × and one percent in the case of a binocular having a nominal magnification higher than 6 ×.

5.2.2 *Field of View* — The field of view shall be measured by means of a scale set up at a known distance from the testing stand and at right angles to the line of sight. The field of view shall not vary by more than 5 percent from the value specified.

NOTE — A tolerance of 5 percent is allowed on magnification and actual field of view subject to a limit of 5 percent on the apparent field of view.

5.2.3 *Parallax* — When the binocular is provided with a graticule, it shall be tested for parallax with the aid of a collimator. There shall not be any apparent movement between the image of the collimator graticule and the binocular graticule when the collimator graticule is observed through the ocular and the eye moved in the rear of the eyepiece at right angles to the axis of the ocular.

5.2.4 *Focus of Eyepieces*

5.2.4.1 *Right hand eyepiece* (*when fitted with a graticule*) — The graticule markings in the ocular shall appear sharp and well defined when the diopter scale reads zero $\pm \frac{1}{4} D$. This may be tested with a dioptric lens test.

5.2.4.2 *Left hand eyepiece* — Using a set up of **5.2.2**, the image of the graticule of the collimator shall appear sharp and well defined when the diopter scale of the eyepiece reads zero $\pm \frac{1}{4} D$.

5.2.5 *Graticule* — When fitted with a graticule, the dimensions of the graticule pattern shall be within 5 percent of the specified design.

5.2.6 *Verticality of Image* — A vertical object, for example, a plumb line, when viewed through the instrument, shall not appear inclined by more than 30 minutes to the vertical.

5.2.7 *Definition* — The flatness of field and definition of the binocular shall be tested by means of a board having concentric circles and radiating lines painted on it, and a plate having square and circular holes (*see* IS : 2754-1964*). When the binocular is aligned on to the centre of the board or plate and focused for the centre of the field, the lines and circles on the board or holes in the plate, shall be clearly and sharply defined without any appreciable amount of colouration over at least two-thirds of the field. The definition and freedom from colour over the remainder of the field shall also be reasonably satisfactory.

5.2.8 *Collimation* — The adjustment of the binocular between the inter-ocular distances of 54 to 74 mm shall be within the limits given below:

a) The optical axes, considered in the direction from the objectives to the oculars shall not:
    1) converge more than six minutes, or
    2) diverge more than two minutes in the horizontal plane, and
    3) diverge more than one and a half minutes in a vertical plane, and
b) A vertical line, when viewed through each ocular, shall appear vertical within a limit of 30 minutes inclination in either direction. In any one binocular the angle of inclination of the image of vertical line in one ocular shall not exceed 30 minutes with respect to the image of this vertical line in the other ocular.

5.2.9 *Veiling Glare Index* — Veiling glare index shall be tested according to the method given in Appendix A of IS : 2754-1964*.

5.2.10 *Paraxial Transmission Factor* — Paraxial transmission factor shall be tested according to the method given in Appendix D of IS : 2754-1964*.

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*General requirements for optical instruments.

5.3 Climatic and Durability Tests

5.3.0 The climatic and durability tests stipulated in IS : 2352-1963* are all type approval tests and cover the tests required for the assessment of a type of an instrument produced for the first time by a manufacturer, though similar instruments planned for production at different times with changes of material or processes may also be subjected to such tests. These tests are not intended for inclusion in performance test series for an instrument. This concept takes for granted an appreciation of a certain level of precision amongst the prospective manufacturers of instruments. Whereas the test series and the severities envisaged in IS : 2352-1963*, shall normally guarantee the quality of the product, elimination of certain assembly and production defects arising out of bad or indifferent workmanship cannot always be ensured if some rough usage or rigidity tests are not prescribed for inclusion amongst the performance tests. Cold and heat tests of a severity normally encountered in our country, drop and watertightness tests are some of those selected for inclusion in performance test series of an instrument to guard against possible production and assembly defects on the part of the producer particularly in a period when the level of an industrial base for precision instrument manufacture has yet to attain maturity in our country from infancy With this aim in view, the following tests have been included in the performance test series of the binocular as 'rough usage' test. Inclusion of these tests as performance tests is expected to help in improving the quality of the product without affecting in any way the life of the instrument.

5.3.1 Rough Usage Test

5.3.1.1 *Watertightness test/rain test*—The watertightness shall be tested by placing the binocular with the eyepiece upwards under a water sprinkler at normal temperature for 10 minutes. No damage shall occur to the exterior of the instrument by this test, and no sign of moisture shall be apparent in the interior.

5.3.1.2 *Rigidity test*—The rigidity of the frame and the fitting of the prisms shall be tested as follows:

a) *Drop test*—The binocular shall be held with its eyepieces upwards and dropped from a height of 150 cm into a box containing a 15 cm layer of ordinary silver sand, covered with a piece of canvas. All adjustments should remain correct within the tolerances indicated against collimation tests.

b) *Cord test*—The ends of a cord 150 cm long shall be attached to the neck-sling lugs and the binocular shall be dropped so that the cord is jerked tight at the end of the fall. The binocular shall pass the collimation test after this drop also.

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*Procedure for basic climatic and durability tests for optical instruments.

5.3.1.3 *Dry heat test*—The binocular shall be tested by heating in an oven to a temperature of 40°C, the rise in temperature not to exceed 10 deg C per hour and to be kept at that temperature for 6 hours. The oven shall then be switched off and the instrument allowed to cool down to room temperature at a rate not exceeding 10 deg C per hour. The binocular shall not be damaged in any way. The adjustment of the binocular shall remain unaffected and the grease in the eyepieces shall not melt.

5.3.1.4 *Cold test*—The binocular shall be subjected to a cold test of severity II as indicated in IS : 2352-1963*.

5.3.2 *Type Approval Tests*

5.3.2.0 The tests listed in Table 1 shall be carried out as type approval tests. These are not to be used in routine testing for performance of instrument during bulk production although these may be used for control testing of batch samples by arrangement between the manufacturer and the purchaser.

5.3.2.1 The tests shall be carried out in accordance with IS : 2352-1963*. The outline of tests and degree of severity shall be as given in Table 1 or as agreed to between the manufacturer and the purchaser.

TABLE 1 TYPE APPROVAL TESTS FOR BINOCULARS

Sl No.	Tests	Degree of Severity	Remarks
(1)	(2)	(3)	(4)
1)	Dry heat	+55°C	—
2)	Damp heat, long term exposure	+40°C, relative humidity 95 to 100 percent, duration 7 days	For sealed type of binoculars only
3)	Damp heat, accelerated	Temperature 55°C, relative humidity 95 to 100 percent, two cycles of 24 hours each	For sealed type of binoculars only
4)	Mould growth	Exposure to selected moulds at 28° to 30°C for 28 days	For sealed type of binoculars only
5)	Salt spray	3 days	The test mentioned in clause 11 of IS : 2352 - 1963* shall also be carried out for 22 hours for sealed type of binoculars only.
6)	Dust and sand	30 minutes	—
7)	Solar radiation	100 hours	—

(*Continued*)

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*Procedure for basic climatic and durability tests for optical instruments.

TABLE 1 TYPE APPROVAL TESTS FOR BINOCULARS — *contd.*

SL No.	TESTS	DEGREE OF SEVERITY	REMARKS
(1)	(2)	(3)	(4)
8)	Driven rain	As specified in IS : 2352-1963*	For sealed type of binoculars only
9)	Thermal shock	Alternate exposure to temperature of 10°C and 55°C, four cycles	For sealed type of binoculars only
10)	Storage	—	—
11)	Drop	Drop five times from a height of 150 cm on to 15 cm thick bed of river sand covered with canvas	The test shall be carried out with the binoculars without case
12)	Vibration	As specified in IS : 2352-1963*	The. test shall be carried out with the binoculars without case
13)	Bump and shock	As specified in IS : 2352-1963*	The test shall be carried out with the binocular packed in a packing case suitable for transit
14)	Leak	As specified in IS : 2352-1963*	For sealed type of binoculars only. The test for leakage shall be carried out after each of the tests at 9, 11, 12 and 13

*Procedure for basic climatic and durability tests for optical instruments.

6. INSPECTION

6.1 Every binocular shall be tested for the requirements mentioned in **5.1**, **5.2** and **5.3.1**. Only the binoculars satisfying these requirements shall be accepted.

7. MARKING

7.1 Each binocular shall be legibly and indelibly marked with the following information:

a) Magnification and diameter of entrance pupil in millimetres;

b) Name or trade-mark of manufacturer;

c) Letters 'TPL' shall be marked in red for sealed type of binoculars only;

d) When the binocular is provided with a graticule, it should be suitably marked; and

e) Any other marking such as serial number or year of manufacture, if desired by the purchaser.

7.1.1 The binoculars may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

8. PACKING AND PACKAGING

8.1 The binocular shall be securely packed for storage and transit along with its carrying case so that there is no possibility of any deterioration or damage in transit.

8.2 The package shall be marked with the description and the number of contents and also with standard symbol for indicating fragile contents (*see* IS : 1286-1958*), together with the legend HANDLE WITH CARE in red and also the symbol for RIGHT-WAY UP.

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*Pictorial markings for handling instructions for non-dangerous goods (Since revised).

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